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THE SUNSETS AND THE JAVA EARTHQUAKE.

WE have always endeavoured to avoid printing in these pages matter which has appeared, or will appear, elsewhere, except in so far as it is indispensable, if our readers are to be kept fully aware of all that is going on in the meteorological world; and we specially object to reprinting anything written by ourselves, it is bad in principle and it looks conceited; yet as regards the subject on which much public interest is now felt, we see no better way of bringing it before our readers than by reprinting in small type a letter which appeared in *The Times* of December 1st, and appending to it items of information and criticism subsequently obtained.

THE SUNSETS AND THE JAVA EARTHQUAKE.

To the Editor of the Times.

SIR,—As the exceptional sunsets (and sunrises) of the present autumn have been referred to in *The Times*, I ask your permission to submit a few facts which seem to me to be related. As, however, the mass of routine rainfall work leaves me little time for other branches of meteorology, I submit the facts rather as an incentive to inquiry by others than as the result of any special investigation by myself. If this letter induces some competent physicist to collect more facts and examine them thoroughly, great good will, I am sure, be done.

For my present purpose terseness is the first essential, and I therefore suppress all references, beyond the general statement that many of the quotations are from *Nature*, some from *The Times*, and the others mostly from letters and newspapers received by myself from various localities.

South East of India and between it and Australia lie the large islands (each of them longer than Great Britain) of Sumatra and Java. They are very long in proportion to their breadth, and their general direction is such that they may be regarded as one long island cut in two by the Straits of Sunda, which are but 15 miles across, or narrower than from Dover to Calais. Nearly in this narrow pass was situate the Isle of Krakatowa, in long. 105° 26′ E., and lat. 6° 8′ S., about five miles long by three broad, and with mountains rising to 2,700 ft. above the sea, covered to the very summit with luxurious tropical vegetation.

On May 20, 1883, to everybody's astonishment, Krakatowa became a volcano, the reverberations being felt at distances of 100 miles. The captain of a passing vessel saw columns of smoke and sheaves of fire rushing up into the atmosphere; miles after he had passed the island, volcanic sand fell on his ship, an "apparently illimitable cloud of drifting pumice was passed through 10 miles away," and at 20 miles another was met with so thick that a bucket was filled with it before it reached the surface of the water. Of course, such an eruption destroyed the vegetation and reduced the island to a desert.

Subsequently a party from Batavia was bold enough to land and partly explore the island. Their report is given at length in *Nature* for November 8, and I therefore quote only one paragraph, because it shows what was going on *before* the great eruption :—

"But in front of the volcano all was wrecked, covered, nay completely buried under pumice dust, which, when the sun shone upon it, became of a yellowish grey colour, while thick masses of condensed vapour, accompanied by incessant fulminations, boiled up from behind the bare and gently sloping dunes. . . . The volumes of vapour were shot out in a strictly vertical direction; the atmospheric pressure in the middle of them must have been something fearful. And from time to time immense funnels became visible, leaning outwards, and into these many of the incessantly changing ravelled wreaths of smoke were sucked. The rest maintained their original form to a height of several thousand feet, then they slowly drifted eastwards [*i.e.* were left behind by the rotating earth], and spreading out into mist, discharged their ashes downwards in black streaks like the dark fringes of rain clouds seen on the horizon."

All these phenomena sink into nothing compared with those of August 26th and 27th, of which we are still without full details owing to the immensity of the catastrophe. The island, with its lofty mountain, seems to have been almost blown away, and the submarine force was such as to produce a wave 30 metres (98 ft.) high, which, sweeping over the low-lands, sucked back with it tens of thousands of the people, while it ruined their houses and lands. (Such a wave would destroy nearly everything in London except the high parts of Pentonville, Notting-hill, and the Regent's Park.) As an indication of its force it is stated that, at Telok Betong, a Government steamer was carried three miles inland.

I wish, however, to deal chiefly with the atmospheric disturbance. We have seen that vast columns of vapour were being projected thousands of feet high *before* the great outburst. What occurred during it we shall probably never know. But we may infer a little from such facts as that ashes fell 250 miles away, and that the whole of North Java became so darkened by the clouds that nothing could be seen except by artificial light for 36 hours.

On September 16th, Mr. J. P. O'Reilly, of Dublin, called attention to the quantity of gases and vapour emitted during eruptions, to their probable relation to the total quantity of matter emitted, and to their exerting some effect upon the atmosphere. But before his letter was published many strange phenomena had occurred.

On September 2nd, just a week after the eruption, it was reported that at Port of Spain, Trinidad, West Indies (!) the sun looked like a blue globe, and after sunset the sky became of so bright a red that it was thought there must be a fire.

Green suns and other unusual chromatic effects in the atmosphere are re-

ported from various parts of Southern India and Ceylon, from about September 8th onwards for several days. Something analogous occurred off East Africa, for Dr. Meldrum, F.R.S., writes :—"The extraordinary sunrises and sunsets observed at Mauritius, Rodrigues, and the Seychelles were probably due to the sun's light passing obliquely through fine volcanic dust floating in the air." In a report respecting September sent to myself, Dr. Meldrum remarks :—"The clouds and sky at sunrise and sunset have been coloured more frequently and to a greater extent than usual. Probably this is partly due to the presence in the air of volcanic dust carried by the upper currents from the Straits of Sunda." And a month later, reporting on the weather at Mauritius in October, he writes :—"Unusually prolonged and intense colourations of the sky before sunrise and after sunset every day, lasting one hour 15 minutes."

My own correspondent at Colombo, Ceylon, reports :—"From September 8th, till about the 15th the rising aud setting of the sun was of an unusual green colour."

But we may go to the other side of the world, and there a correspondent (who scarcely ever sends anything but numerical *data*) states that at Barbados "the sun was various coloured on evening of September 15th and morning of 16th." I have already quoted the blue sun at Trinidad.

At Barinas, Venezuela, South America, on September 2nd, from sunrise to noon, and from 3 p.m. to sunset, the sun looked like burnished silver ; between noon and 3 p.m. it was bluish green.

In New Zealand I am told that the sunsets have been gorgeous beyond precedent.

Lastly, in smoky London the sunrises and sunsets of the past month or six weeks have on several occasions been extremely beautiful.

As regards the phenomena in Java itself, there is no doubt that the Government of Netherlands India will give us full information, for it has long supported meteorological research with great liberality. Previous to the disaster the observatory at Batavia was equipped with first-class continuously recording instruments, and if they escaped destruction their records will be of intense interest.

Besides this principal observatory, there were 151 rainfall stations at work on January 1, 1882, and, although doubtless in some cases both observer and rain gauge were carried away by the tidal wave, there can be no doubt that from such a staff, reports of the very highest interest will be obtained.

The losses of the Government are, however, so frightfully great, that I think the investigation of the effects over the whole globe should not devolve upon them ; they will have quite enough to do in investigating the local phenomena.

I am, Sir, your obedient servant,

G. J. SYMONS.

62, *Camden-square, N. W., Nov.* 29.

As one or two writers have not caught exactly the explanation of the phenomena which we intended to convey in the foregoing letter, we think it best to state it in the very plainest words, so as to avoid all misunderstanding, especially as in all probability this will be the last that we shall write upon the subject, several very able men having undertaken to study it.

As the eruption was powerful enough to blow away a mountain 2,700 ft. high, we need not discuss whether there was sufficient projectile force to send some millions of cubic feet of pumice dust through an atmosphere whose total resistance would be 15 lbs. to the square inch—say equal to 12 ft. of ordinary earth. As regards the existence of sufficient pumice dust, besides the unknown quantity which may have been ejected in August, we know that large tracts of Krakatowa were previously "covered, nay completely buried under pumice dust." And even had it been but 1 foot deep, it would give 27,878,400 cubic feet of dust per square mile.

Our idea is that some of the volcanic dust was shot up with such force as to pass through nearly the whole of our atmosphere, and that this fine dust being thus above all winds, and too light in density to be much affected by gravity, was left behind by the earth in its rotation, and would thus soon be seen in the opposite hemisphere to Java. There has not yet been time to investigate the facts, but our impression is that it will be found that for a considerable time the chromatic phenomena were confined between the two tropics, and that it was only subsequently that they were seen in temperate latitudes.

Some writers say that the sunsets, &c., in this country are merely due to ice spiculæ at great elevation, but how comes it that there are extra numbers of such spiculæ at Barbadoes, Madras, Mauritius, South America, South Africa, New Zealand, Ceylon, &c.? and will ice spiculæ produce green and blue suns and moons?* We have heard that the green moon is but the effect of the over-excitement of the retina by the excess of red in the surrounding sky, but we shut off the red sky and yet perceived the green tint. And as regards the ice spiculæ, they must not only be exceptionally widespread, but also unprecedentedly high, or twilight could not be prolonged so exceptionally as it has been, while this prolongation falls in perfectly with the idea of a lofty cloud of dust. As regards the prolongation, besides the facts from Mauritius recorded in the above letter, we may call attention to a letter in the *Standard* of November 30th, in which Mr. E. A. Jackson, writing from Skegness, on the edge of the Lincolnshire fens, states that on November 26th, although sunset occurred at 3.57 p.m., "the western heavens were all aglow until 6.30 p.m." Surely this shows that the matter must be almost, or quite, beyond our atmosphere, to be transmitting to us solar light when the sun has been below the horizon for more than 2½ hours.

Many persons have ascribed the appearances to aurora; they might as reasonably have ascribed them to fog.

One correspondent thinks that the earth is passing through a portion of space where the ether is denser than usual; if so, the phenomena should occur simultaneously all over the globe, which does not seem to have been the case.

* Ought they not also to have given an excess of solar and lunar halos?

We have scores of notices of remarkable sunsets, but few contain precise data as to time, and therefore we are not sure that they need be printed. It may, however, be well to remark that they are mostly from the southern half of Ireland, from East Scotland, and from S, S.E., central and E. England. In other parts it is probable that clouds and rain prevented the phenomena being seen. The following letter gives, we think, the best account of the phenomena of November 26th :

To the Editor of the Meteorological Magazine.

SIR,—Permit me to report a very remarkable phenomenon. On Monday last (26th November), about 4.40 p.m., *i.e.*, half-an-hour after sunset, a most strange unearthly light suddenly shone over the whole landscape here, land and sea, and with a brilliance that rivalled that of the mid-day sun. The source of it was in the western sky, where hung (about 45° up) a hazy undefined looking cloud, the under surface of which, about twenty times the area of the face of the sun, shone for half-an-hour or so with the most brilliant, soft, silver light. At the end of this time, the upper mass of the cloud began slowly to change its colour from black through yellow to deep purple, the whole cloud losing its brilliancy and gradually stretching itself out, throwing out ragged-looking purple arms, which contrasted strikingly with the deep green and blue sky. It seemed, at the same time, to be moving westward, and in about half-an-hour's time from the commencement of the illumination it had disappeared. The sunsets of Tuesday and Wednesday were followed by a very bright and beautifully-coloured western sky, but nothing like that of Monday.—Yours,

WILLIAM MARTIN.

Weston Hall, Bournemouth, Hants, 1st December, 1883.

The *Times* of December 8th, contains a long article upon the subject by Mr. Norman Lockyer, F.R.S., in which he follows the same lines as Mr. Symons, but in much greater detail. He concludes by mentioning, as a difficulty, that somewhat similar appearances were seen in 1831 with no special seismic phenomena to cause them "unless it be the elevation of Graham's Island, in the Mediterranean.'

We do not know where the appearances Mr. Norman Lockyer refers to were seen, but we think that the following paragraphs which we put side by side may very well conclude our notice of the sunsets and the Java earthquake :—

BERMUDA. — "On the morning of August 11th, 1831, I rose early, for the purpose of writing, and soon discovered, the light was so dim, I could not proceed. I removed to another room, and finding my situation not improved, I said, in the presence of one of my family, I apprehend a sudden failure of sight. I was then asked if I had not observed a very peculiar appearance of

BARBADOS, August 11th, 1831. —"Earthquake shocks were felt during a violent hurricane which raged over the West Indies, especially Antigua, St. Vincent, Dominica, Guadeloupe and Barbados. It lasted from 2.30 a.m. to 5 p.m. Barbados suffered at once from the hurricane, the earthquake and a volcanic eruption. 3,000 persons

the sun's rays the day before. I had not; but had perceived the floor of the room to look blue, especially where the sun shone upon it; indeed every object in the room appeared of a sickly blue colour. The next day, the 12th, a mail boat was put under weigh for the first time, with a party on board. The day was so mild and tranquil, we could only reach a few miles; the sails, which were new and pure white, nevertheless appeared to be stained of a bluish colour, and the sea was of a dingy yellow. On the first arrival from the West Indies we heard of the devastation at Barbados; but with us there were no subsequent unusual appearances; on the contrary, we had very fair weather, although I heard [that] this singular blue colour was observed, even to the coast of America —A. W HARVEY, M.D.—*Brit. Ass. Report*, 1840, p. [11].

perished altogether." — "Mallet's Earthquake Catalogue." *Brit. Ass. Report.*, 1854, p. 226.

P.S.—We are becoming a second Krakatowa, but buried under paper instead of pumice. Twice have we recast the above article, and every day brings fresh materials. However, we have little doubt that before another month comes round, some arrangement will be made for the concentration and preservation of a complete record of probably the most tremendous manifestation of seismic energy which has occurred within historic times; and when that has been settled, we shall with pleasure transfer to the proper party all the data we receive.

We must add only a few brief notes.

If these sunsets are due to dust, it is probable that ere very long that dust will fall on the earth; and, therefore, it is desirable to carefully examine the sediment of rain, and especially that from melted snow. Arrangements have been made to secure this being done on Ben Nevis, and on the Puy de Dôme in Auvergne.

The Editor of the *Panama Star* reported a green sun at Panama, Sept. 2nd and 3rd, and attributed it to Krakatowa.

From Port Elizabeth, Cape Colony, we hear that up to Oct. 20th, "the heavens are aflame with it nightly."

The sea beach at Natal on October 31st, and at Kurrachee in N.W. India (date not stated), are each said to have been strewn with pumice and with ashes washed up by the sea.

At Kurrachee, up to about Oct. 21st, the light continued greenish; while in S. Africa it was roseate.

Lastly, we reprint verbatim the report with which we have been favoured by our excellent correspondent, Mr. Todd, C.M.G., Government Observer, describing the appearances observed at Adelaide, South Australia:—

"On every clear evening during October, and the last fortnight

of September, a peculiar phenomenon has been apparent in the western sky. Shortly after sunset, a red glow will make its appearance at an altitude of about 50°, being very faint at first, but as the brightness of the sky near the horizon dies away with the receding sun, the red glow will expand downwards, becoming at the same time more brilliant, until at last the whole western sky will be lit up with a beautiful light, varying in colour from a delicate pink to a most intense scarlet, and the spectacle presents a most brilliant appearance. The upper part will then gradually fade away until the colour is noticeable only 7° or 8° above the horizon, at which time the light is at about its brightest. Afterwards a secondary glow will sometimes make its appearance at an altitude of about 50°, and gradually spread downwards until the sky is again lit up. In the secondary phenomenon, the colours are generally more delicate. The whole thing will fade away about 8 p.m.

"This phenomenon has been noticed all over the south-eastern portion of this continent, from Port Augusta (lat. 32° S.) to Melbourne; and in India, the sun has at times presented a most peculiar appearance, being green at rising, then gradually changing to a blue at noon, and inversely from noon to sunset. Various theories have been started to account for the phenomena."

HEAVY RAIN IN NORTH LONDON, SEPT. 17TH.

To the Editor of the Meteorological Magazine.

SIR,—On receiving last month's Magazine, I was disappointed at not finding any reference to the heavy rainfall of September 17th. which occurred in the neighbourhood of Holloway and Crouch Hill; by the accounts in the public press, the fall of rain was sufficient to flood the roads to a considerable depth, and to stop the traffic for some hours on the Midland Railway at Crouch Hill. Have none of your observers in that district made any note of the rainfall of that day with their monthly returns? The only station of rainfall observation to which I have access, is at Muswell Hill, where ·28 in. fell in about 35 minutes, but this is some three miles from the spot where the storm was reported to be heaviest. *Here* no rain fell, but thunder was heard in the distance.—I am Sir, Your's truly,

J. W. SCOTT.

Springlands, Great Stanmore, Nov. 7, 1883.

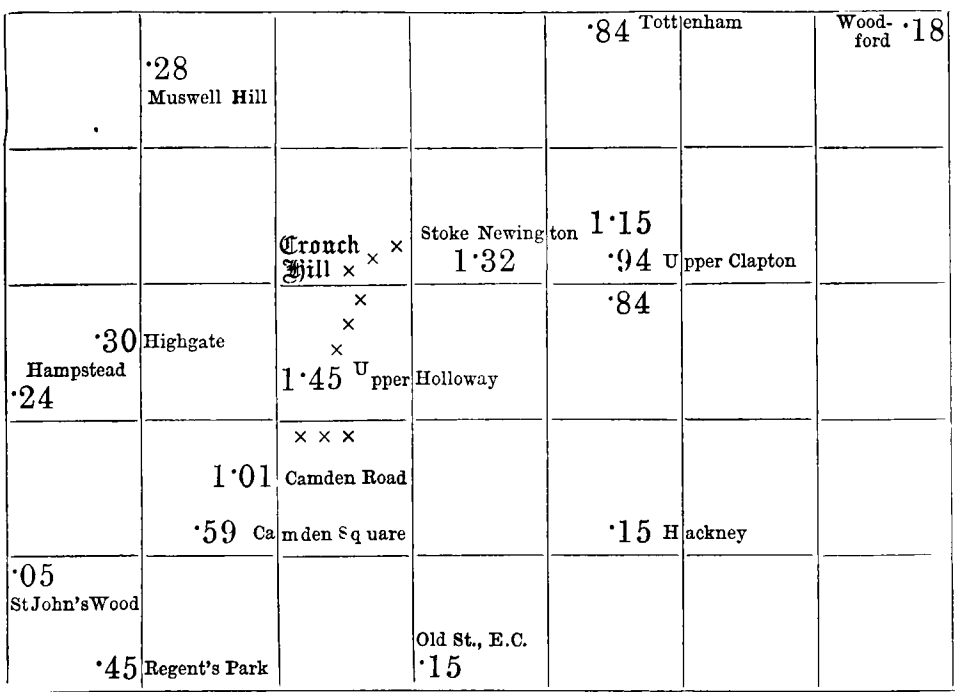
[As London grows, as all its natural watercourses are filled up or converted into sewers, as garden ground with its powers of absorption is changed into acres of slated roofs and paved streets, the influence of a heavy rain becomes more noticeable, and those who live at the bottom of hills resent the speed with which torrential rains run down upon them, and complain that the Metropolitan Board of Works has not made its sewers large enough to carry away the produce of every thunderstorm. But some such complaints are so un-

reasonable as to become ludicrous, *e.g.*, a correspondent says that the rain which we are about to describe converted the Holloway Road into a river 100 ft. wide and 3 or 4 ft. deep in parts,* and he goes on to suggest that a sewer (evidently nearly as large as a railway tunnel) should be made to carry it off. He does not volunteer to bear the cost of such a work.

However, we have to deal only with the fall of rain—and that we do very briefly inasmuch as the following map-diagram gives nearly all the facts. The squares represent square miles and therefore the area represented is 35 square miles, of which the 15 south-western-most miles are almost wholly built over, and the others partially.

SKELETON MAP OF N.E. LONDON,

Showing fall of Rain during Thunderstorm on afternoon of September 17th, 1883.



The sites of flooding were chiefly near the localities marked by × × ×.

The sites of sixteen rain gauge stations are indicated by the decimal point of the amounts recorded at each, or as nearly so as the exigencies of type will permit.

There is a hill called Crouch Hill to the north of Upper Holloway,

* One of our own correspondents saw the water in the Holloway Road nearly up to the floor of the omnibuses—this would prove that in the lower parts of the road water must have been more than 2ft. deep.

where the upper row of × × × are placed, and it seems probable that it was the site of the heaviest rainfall, which very possibly may have amounted to two inches. It was, however, not the quantity of rain which caused the damage, but the rapidity with which it fell. The local newspaper, the *Holloway and Hornsey Press*, says that "an enormous quantity of rain fell within about twenty minutes," and that this was approximately true is shown by the Casella's recording gauge at Camden Square, which gave—

Rainfall at Camden Square, September 17th, 1883.						Possible fall at Crouch Hill.				Actual fall at Camden Square in 1878.
From	3·15 p.m.	to	3·20 p.m.	...	0·06 in.	...	0·20 in.		0·28 in.
,,	3·20 ,,	,,	3·25 ,,	...	0·16 ,,	...	0·55 ,,		0·54 ,,
,,	3·25 ,,	,,	3·30 ,,	...	0·22 ,,	...	0·74 ,,		0·46 ,,
,,	3·30 ,,	,,	3·35 ,,	...	0·07 ,,	...	0·24 ,,		0·28 ,,
,,	3·35 ,,	,,	3·40 ,,	...	0·05 ,,	...	0·17 ,,		
,,	3·40 ,,	,,	4·0 ,,	...	0·03 ,,	...	0·10 ,,		

We are not going to be bound by the wild bit of theory given under the remarkable heading, "Possible Rainfall at Crouch Hill," but will state how it is obtained, and wherein, if at all, it is most likely to be wrong. An examination of the Map will show that the amounts decrease from an imaginary centre north of Upper Holloway, and the rates of decrease are such as to indicate a fall of 2·00 in. at the centre. The fall at Camden Square for each 5 minutes being known, the imaginary 2·00 in. at Crouch Hill, has been divided in the same proportions. The weak point is that it is not known for certain that the fall there did not last longer. However, this calculation gives 1·73 in twenty minutes, and the last column shows that a fall of 1·56 in. in twenty minutes was recorded at Camden Square, in 1878. (*British Rainfall*, 1878, page [79]. And a considerably higher rate was recorded in a storm at Canterbury in 1875, when 2·12 in. fell in twenty minutes.

The immediate disposal of even half-an-inch of rain falling on a square mile of London houses within five minutes, *i.e.*, of about seven million gallons in five minutes is not easily accomplished. —[ED.]

RAINFALL AT RODRIGUES AND SEYCHELLES.

To the Editor of the Meteorological Magazine.

DEAR SIR,—In accordance with the promise which I made during my stay in London, I now send the returns of rainfall from Mahé, the chief island of the Seychelle group, and from Rodrigues, which were sent to me last year by Dr. Meldrum, F.R.S.

The observations were made with gauges 8 inches diameter, standing on the ground.

The seasonal means are as follows :

	Winter. D.J.F.	Spring. M.A.M.	Summer. J.J.A.	Autumn. S.O.N.
	in.	in.	in.	in.
Seychelles (3½ years)...	40·59	30·18	7·02	23·38
Rodrigues (6½ years)...	15·24	12·47	10·47	4·92

The former is my *régime* I. (as at Moulins).
Rodrigues ,, VII. (as at Bar le Duc).

Yours very truly, V. RAULIN.

Rue du Colisée, Bordeaux.

RAINFALL OF RODRIGUES

(Lat. 19° 40′ S. ; Lon. 63° 30′ E.) Altitude, 20 feet.

By M. YOULTEN before 1880, and M. WALLIS in 1880-81.

	Amount.								Days.		
Years.	1875	1876	1877	1878	1879	1880	1881	Mean	1879	1880	1881
	in.	in.	in.	in.	in.	in.	in.	in.			
January.	...	10·20	7·47	3·86	5·88	2·64	·65	5·12	25	18	12
Feb. ...	...	11·83	8·91	8·13	2·81	5·16	1·58	6·40	20	25	16
March ...	...	·73	11·09	8·96	3·63	2·57	2·00	4·83	23	23	15
April ...	...	4·87	5·00	10·97	2·35	3·81	5·95	5·49	24	22	22
May.....	...	·90	1·23	4·27	2·15	2·72	1·61	2·15	22	25	18
June ..	...	2·19	3·66	1·80	8·85	10·01	3·86	5·06	27	27	23
July.....	...	3·01	1·85	3·98	2·89	2·39	2·95	2·84	26	21	22
August .	1·87	1·68	4·67	1·39	3·02	3·58	1·76	2·57	26	24	22
Sept.....	·65	2·38	1·63	·84	2·43	·83	·94	1·39	23	17	15
October .	·83	1·84	1·35	·28	2·29	·77	·83	1·17	25	14	12
Nov	·92	5·26	4·82	2·32	·30	·70	2·18	2·36	12	7	10
Dec.....	5·42	5·59	2·66	·90	8·01	·27	3·18	3·72	20	12	19
Totals	...	50·48	54·34	47·70	44·61	35·45	27·49	43·10	273	235	206

RAINFALL OF MAHÉ SEYCHELLES,

(Lat. 3° 15′ S. ; Lon. 55° 30′ E.) Altitude, 75 feet.

By M. BARROW in 1876-77, and M. ESTRIDGE in 1880-81.

	Amount.					Days.			
Years.	1876	1877	1880	1881	Mean	1876	1877	1880	1881
	in.	in.	in.	in.	in.				
January	...	...	18·40	13·45	15·92	...	...	20	22
February ..	...	8·15	12·75	15·65	12·18	...	11	18	20
March	...	7·53	12·93	19·02	13·16	...	13	15	22
April	...	10·12	6·40	10·67	9·06	...	13	14	14
May..... ..	10·73	12·75	3·79	4·56	7·96	18	10	12	11
June	4·79	...	1·05	·56	2·13	16	...	13	10
July.....	1·77	3·21	·51	2·49	1·99	12	11	9	16
August	5·26	2·60	·58	3·15	2·90	10	9	12	16
September..	·79	9·62	1·19	12·94	6·14	4	22	12	25
October	6·11	13·52	5·21	9·35	8·55	10	19	9	15
November ..	16·15	7·70	4·37	6·53	8·69	7	14	16	14
December ..	11·37	14·52	6·62	17·46	12·49	11	14	19	26
Totals	56·97+	89·72+	73·80	115·83	101·17	88+	136+	169	211

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1883.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	79·6	24	31·0	4	64·8	44·5	44·1	71	121·6	26·3	1·97	11	5·5
Cape of Good Hope	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	80·7	1	63·5	18	77·7	69·2	65·4	77	...	...	6·25	18	5·3
Calcutta	100·2	24	69·6	4	94·1	78·9	77·2	75	163·0	68·2	1·18	7	4·5
Madras	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay	92·3	31	77·6	2*	90·3	80·0	76·1	74	147·6	71·0	·33	5	2·4
Ceylon, Colombo	90·3	21	72·8	9†	87·5	77·9	74·2	76	155·0	69·0	18·62	17	...
Melbourne	78·5	5	35·8	10	61·2	44·4	45·0	77	123·5	27·5	1·98	13	6·0
Adelaide	76·3	2	40·0	20	62·0	49·5	46·2	70	130·1	31·1	6·46	22	5·5
Wellington	62·0	18‡	39·3	9	57·9	48·4	...	..	119·0	35·0	8·02	17	...
Auckland	66·5	20	43·0	9	62·7	51·1	51·3	82	139·0	37·5	6·50	17	5·5
Falkland Isles	48·8	22	28·3	15	44·2	35·7	37·4	90	98·3	21·0	1·69	21	7·7
Jamaica, Kingston	90·3	14	68·3	20	87·5	72·7	71·6	77	...	64·0	1·15	12	4·6
Barbados	84·0	19	71·0	27§	82·0	73·0	73·3	81	146·0	70·0	2·32	9	6·0
Toronto	72·7	25	31·1	13	58·3	40·2	40·8	69	134·0	23·0	4·30	19	6·8
New Brunswick, S. John	69·0	21	32·0	1	54·4	40·2	42·2	82	...	...	5·52	16	6·4
Manitoba, Winnipeg	72·8	16	20·0	12	57·6	32·7	38·0	68	126·0	...	1·27	7	5·4
British Columbia, Yale	...	...	...	...	...	...	...	...	...	...	...	...	...

* And 4. † And 10. ‡ And 27, 28. § And 31.

Remarks, May, 1883.

Mauritius.—Rainfall 2·62 in., and mean temp. 0°·2 above the average; mean pressure 30·085 in.; mean hourly velocity of wind 10·6 miles, extremes 30·8 miles and 1·7 miles; prevailing direction E.S.E.; T on 9th. C. Meldrum, F.R.S.

Ceylon.—TSS occurred on every day till the 11th; T heard on 26th; L seen on 27th and 28th. G. H. Symonds.

Melbourne.—Mean temp. of air and dewpoint below the average; mean pressure and humidity about the average; amount of cloud and rainfall slightly below it; prevailing direction of wind N. and N.E., strong breezes on 5 days; heavy dew on 10 days, hoar frost on 4 days; fog on 3 days; T and L on 16th. R. L. J. Ellery, F.R.S.

Adelaide.—An exceptionally wet May, in fact the wettest with one exception (1875) since the commencement of the observatory records; the total fall is more than double the average of 26 years. The R extended a little beyond Point Augusta, but N. of this it does not appear to have been very copious; mean pressure and temp. below the average. C. Todd.

Wellington.—Showery, unpleasant weather up to the 7th; heavy R from 11th to 13th, 1·95 in. falling on the latter day; from 14th to 21st fine, with northerly winds; from 22nd to 28th showery, with at times heavy R and very unpleasant weather; winds N.W.; remainder of month fine; strong S.E. gale on the night of 12th; also on 13th; strong N.W. wind on 25th and 26th; very low bar. on 28th, 29·054 in., with heavy R; fog on 22nd, 23rd, and 24th; mean pressure and temp. both very slightly above the average. R. B. Gore.

Auckland.—Pressure and temp. about the average; rainfall greatly in excess. F. F. Cheeseman.

Barbados.—Mean temp. (76°·6) slightly below the average; direction of wind very uncertain; rainfall 50 per cent., and evaporation 9 per cent., below the average; TSS on 27th and 30th, and L on 29th; one day overcast. R. Bowie Walcott.

SUPPLEMENTARY TABLE OF RAINFALL, NOVEMBER, 1883.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	4·45	XI.	Llanfrechfa Grange	5·86
,,	Margate, Birchington...	2·97	,,	Llandovery	6·65
,,	Littlehampton	4·54	,,	Solva	4·78
,,	St. Leonards	4·48	,,	Castle Malgwyn	6·27
,,	Hailsham	5·34	,,	Rhayader, Nantgwillt..	9·70
,,	I. of W., St. Lawrence.	5·00	,,	Carno, Tybrith	7·62
,,	Alton, Ashdell.....	5·47	,,	Corwen, Rhug	3·91
III.	Winslow, Addington ...	3·13	,,	Port Madoc	6·19
,,	Oxford, Magdalen Col...	3·11	,,	I. of Man, Douglas	5·43
,,	Northampton	2·86	XII.	Carsphairn	...
,,	Cambridge, Beech Ho...	2·53	,,	Melrose, Abbey Gate..	2·99
IV.	Southend	2·33	XIII.	N. Esk Res. [Penicuick]	4·15
,,	Harlow, Sheering	2·52	XIV.	Ayr, Cassillis House ..	6·65
,,	Diss	3·14	,,	Glasgow, Queen's Park.	5·82
,,	Swaffham	4·06	XV.	Islay, Gruinart School..	5·03
,,	Hindringham	3·51	XVI.	St.Andrews,NewtonBk	3·01
V.	Salisbury, Alderbury...	4·46	,,	Aberfeldy H.R.S.	...
,,	Warminster	4·52	,,	Dalnaspidal H.R.S. ...	8·72
,,	Calne, Compton Bassett	3·60	XVII.	Keith H.R.S.	1·66
,,	Beaminster Vicarage ...	4·65	XVIII.	Forres H.R.S.	1·52
,,	Ashburton, Holne Vic..	8·35	,,	Strome Ferry H.R.S....	10·25
,,	Torrington, Langtree W.	...	,,	Lochbroom	8·00
,,	Lynmouth, Glenthorne.	8·26	,,	Tain, Springfield.....	2·56
,,	Probus, Lamellyn	6·92	,,	Loch Shiel, Glenaladale	17·16
,,	Taunton, Fullands	3·63	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	4·95	,,	Forsinard H.R.S.	4·44
,,	Ross	3·16	,,	Watten H.R.S.	2·48
,,	Wem, Sansaw Hall.....	3·36	XX.	Fermoy, Glenville	5·72
,,	Cheadle, The Heath Ho.	3·69	,,	Tralee, Castlemorris ...	5·82
,,	Worcester, Diglis Lock	3·77	,,	Tipperary, Henry Street	5·40
,,	Coventry, Coundon	4·70	,,	Newcastle West	6·17
VII.	Melton, Coston	3·73	,,	Kilrush	...
,,	Ketton Hall [Stamford]	3·82	,,	Corofin	6·33
,,	Horncastle, Bucknall ...	3·12	XXI.	Carlow, Browne's Hill..	3·80
,,	Mansfield, St. John's St.	3·08	,,	Navan, Balrath	3·38
VIII.	Macclesfield, The Park.	3·45	,,	Athlone, Twyford	5·38
,,	Walton-on-the-Hill.....	3·11	XXII.	Mullingar, Belvedere...	4·31
,,	Lancaster, South Road.	4·99	,,	Clifden, Kylemore	...
,,	Broughton-in-Furness ..	7·06	,,	Crossmolina, Enniscoe..	7·00
IX.	Wakefield, Stanley Vic.	2·19	,,	Carrick-on-Shannon ...	4·16
,,	Ripon, Mickley	2·94	XXIII.	Dowra	...
,,	Scarborough.....	3·05	,,	Rockcorry.....	4·14
,,	East Layton [Darlington]	1·42	,,	Warrenpoint	4·02
,,	Middleton, Mickleton ..	2·65	,,	Newtownards	2·90
X.	Haltwhistle, Unthank..	3·59	,,	Belfast, New Barnsley .	4·99
,,	Shap, Copy Hill	8·39	,,	Bushmills	5·00
			,,	Buncrana	4·58

NOVEMBER, 1883.

r.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max Deg.	Date	Min. Deg	Date.	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·78	+ ·34	·40	4	16	55·8	28	28·7	13	5	16
II.		Maidstone (Hunton Court)...	3·86	+ ·96	·53	25	18	...	...	...	...	...	...
,,		Strathfield Turgiss	2·54	— ·21	·41	24	22	56·6	28	23·4	13	6	26
III.		Hitchin	2·80	+ ·19	·43	5	19	53·0	6, 25	25·0	11	10	...
,,		Banbury	2·95	+ ·24	·57	5	18	55·0	28*a*	24·0	15*c*	9	...
IV.		Bury St. Edmunds (Culford)	3·24	+ ·41	·71	30	21	55·0	25	22·0	11	...	..
,,		Norwich (Cossey)	3·69	+ ·38	·84	5	21	55·0	1, 25	28·0	12	1	9
V.		Bridport	3·68	...	·57	15	17	...	..	...	...	...	...
,,		Barnstaple.....	7·51	+ 3·36	·71	7	23	58·5	30	28·0	14	...	..
,,		Bodmin	5·58	+ ·26	·68	15	23	56·0	28	33·0	14	0	4
VI.		Cirencester	4·05	+ 1·07	·70	22	17	..	...	...	...	...	...
,,		ChurchStretton(Woolstaston)	5·25	+ 1·81	1·03	5	20	56·0	28	30·5	13	5	17
,,		Tenbury (Orleton)	4·38	+ 1·52	·66	5	23	58·2	28	19·7	15	14	15
VII.		Leicester	4·00	...	·90	5	22	56·0	28	23·0	12	4	24
,,		Boston	2·82	+ ·45	·95	17	16	55·0	25	29·0	12	...	...
,,		Grimsby (Killingholme).....	2·94	— ·16	·66	30	21	54·5	25*b*	30·0	12	1	...
,,		Hesley Hall [Tickhill].....	2·63	...	·57	30	19	56·0	28	25·0	12	5	...
III.		Manchester (Ardwick).....	...	...	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ..	1·90	— ·86	·32	7	14	...	...	...	...	...	...
,,		Skipton (Arncliffe)	7·32	+ 1·57	·86	4	26	53·0	28	27·0	6	7	...
X.		North Shields	1·01	— 2·44	·13	15	22	58·2	28	29·0	12*d*	6	10
,,		Borrowdale (Seathwaite).....	19·84	+ 8·02	2·98	24	23	...	...	...	...	...	..
XI.	WALES.	Cardiff (Ely).....	6·79	+ 2·59	·88	21	22	...	...	...	...	...	...
,,		Haverfordwest	7·44	+ 2·10	1·09	5	22	57·0	2	24·0	13	5	9
,,		Plinlimmon (Cwmsymlog) ...	7·09	...	·92	4	22	...	...	...	...	...	...
,,		Llandudno.....	2·71	— 1·20	·52	30	19	59·0	28	31·8	13	1	...
XII.	SCOTLAND.	Cargen [Dumfries]	5·23	+ 1·32	·90	24	23	54·8	3	24·0	12	8	...
,,		Hawick	2·99	— ·32	·40	4	18	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	6·79	+ 3·24	1·35	24	20	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	9·11	+ 3·75	1·00	19	25	...	...	...	...	...	...
,,		Appin (Airds)	8·84	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	8·31	...	1·05	3	26	...	...	...	...	...	.
XVI.		Loch Leven Sluices	5·50	+ 1·95	1·10	23	14	...	...	...	...	...	...
,,		Arbroath	1·69	— 1·46	·30	24	16	54·0	28	29·0	8, 18	6	...
XVII.		Braemar	3·04	— ·73	·56	10	18	53·2	29	22·0	12	16	27
,,		Aberdeen	1·80	...	·35	24	16	56·0	28	27·0	6	12	...
XVIII		Skye (Sligachan)	25·87	...	4·35	26	24	...	...	...	...	...	...
,,		Culloden	2·48	— ·22	..	...	...	55·0	29	27·0	16	5	22
IX.		Dunrobin	2·70	...	·52	4	13	56·0	1	28·0	18	10	...
,,		Orkney (Sandwick)	4·94	+ ·50	·57	3	27	52·3	28	33·3	7	0	12
XX.	IRELAND.	Cork (Blackrock)	...	...	...	...	...	...	...	...	...	...	...
,,		Dromore Castle	9·23	...	·90	5	29	58·0	1	32·0	6	1	...
,,		Waterford (Brook Lodge) ...	4·01	...	·45	29	25	55·0	3	29·0	8	4	...
,,		Killaloe	7·82	...	·72	21	23	61·0	1	31·0	7	8	...
XXI.		Portarlington	3·39	+ ·99	·54	5	22	57·0	28	27·5	14	6	...
,,		Dublin (FitzWilliam Square)	3·07	+ ·79	·88	5	19	58·7	28	29·4	15	2	6
XII.		Ballinasloe	4·66	+ 1·66	·55	24	27	54·0	28	28·0	14	7	...
XIII.		Waringstown	3·40	+ ·69	·72	15	18	58·0	28	20·0	14	10	19
,,		Londonderry (Creggan Res.).	5·34	...	·76	15	26	...	...	...	...	...	...
..		Omagh (Edenfel)	5·50	+ 2·45	·68	24	26	59·0	29	26·0	13	7	...

+ Shows that the fall was above the average ; — that it was below it.

a And 29. *b* And 28. *c* And 16. *d* And 18.

METEOROLOGICAL NOTES ON NOVEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The month of November was much finer than the average; although it rained on 22 days, by far the greater portion fell at night, and a much larger breadth of wheat has been sown in consequence, and it is looking well.

BANBURY.—Mean temp. 41°·7; high wind on 7 days, fog on 9 days, H on 3 days, L on 25th.

CULFORD.—A very unsettled month, but mild, and occasionally fine bright days.

BODMIN.—Mean temp. 45°·3.

CIRENCESTER.—A seasonable month without much fog; some pleasant days.

WOOLSTASTON.—Mean temp. 41°·8; a severe gale occurred on the 4th, followed by storms of sleet and H for several days, the H on the evening of the 9th falling with great violence.

ORLETON.—The temp. of the month was variable, but upon the whole more than 0°·5 above the average; it was very cold in the middle of the month, with frequent severe frosts; the sky was generally clouded, and there was much R and only a few bright days; great darkness with heavy R for an hour or two on the 17th and 20th; L and distant T on 20th. The land was very wet, and much wheat was unplanted at the close of the month.

LEICESTER.—The month was very unsettled, the changes coming very quickly; on 13 nights, at 9 p.m., the sky was clear and bright, but in nearly every case R came before morning; on 12th there was a dense fog, lasting all day; on the 18th there were great floods in the country, the result of the heavy R on the 17th (·87 in.)

KILLINGHOLME.—A seasonable month, colder than usual until the last week, when it was milder; the last day very wet.

HESLEY HALL.—Very mild during the last week of the month; a storm of wind and R, with a little S on 19th.

ARNCLIFFE.—S on 9th and 14th; heavy H, T and L on 18th; heavy H showers on 19th.

WALES.

HAVERFORDWEST.—A very stormy, unsettled and wet month; the first two days mild and relaxing, afterwards stormy with heavy rainfall until the 9th, the air then became gradually colder and drier with strong N. and N.W. winds, and from 12th to 14th sharp frost prevailed; the 14th was very dark necessitating the use of lamps, it cleared towards evening, this was followed by a period of very stormy weather and constant R, N.W. winds blowing with great force; on 23rd, the Precelly Mountains were white with S; a great bar depression passed over on 25th, and the weather continued broken for a day or two.

LLANDUDNO.—The mean temp. of the month was slightly above the average, and the range both monthly and diurnal slightly below it; the weather, though occasionally hazy, was on the whole fine and seasonable, there being only one night's frost, and that slight; geraniums, veronicas, roses, and other tender plants in flower at the close of the month; duration of bright sunshine 58 hours.

SCOTLAND.

CARGEN.—A very dull gloomy month, the latter half very wet; duration of sunshine considerably below the average; mean temp. 41°·9, slightly above the average; very bright L on 9th.

HAWICK.—With the exeeption of the 19th, 20th, and 21st, which were

wintry days, the month was genial, and out-door labour was carried on without a hitch.

QUINISH.—A month of almost incessant wind and R, except from 11th to 15th.

ABERDEEN.—The weather during the month was exceptionally fine and mild, with prevailing S.W. winds; rainfall more than an inch below the average. Aurora was seen on 19th and 22nd; L on 4th and 18th.

CULLODEN.—The month generally was favourable for agricultural labour, the weather being particularly fine and mild during the last 10 days; on the 25th a great barometric depression occurred, the mercury falling to 28·320 in. at 3 p.m., but without any storm following.

ORKNEY, SANDWICK.—Rainfall above the average, mean pressure much below it; T and L on 4th and 19th, L on 18th, aurora on 3rd and 22nd. The sea on 19th was remarkably rough, huge waves sweeping far above high water mark, and endangering life and property.

IRELAND.

DROMORE CASTLE.—A month of incessant R, only one day on which less than ·01 in. fell; H on 7th and 19th.

WATERFORD, BROOK LODGE.—Rainfall rather above the average. S on Comeragh Mountains on 10th, H on the 20th and 25th, S.W. gale on 23rd and 24th.

KILLALOE.—The whole month wet and wintry in the extreme; T and L very frequent on the nights of 18th and 19th.

DUBLIN, FITZWILLIAM SQUARE.—A very unsettled, and rather cold month, notwithstanding the occurrence of many bright, sunny days; the mean temp. was only slightly below the average, but this was owing in great measure to a remarkable excess of temp. from the 27th to 30th and to the absence of any extreme cold, rainfall and number of rainy days above the average; L seen on 25th, solar halos on the 5th and 23rd, H and sleet fell on 19th and 20th; fog on 7 days.

BALLINASLOE.—A very wet stormy and dreary month, T and L on 19th, L on 21st.

ROYAL METEOROLOGICAL SOCIETY.

The first meeting of the present Session was held on Wednesday evening, November 21st, at the Institution of Civil Engineers, Mr. J. K. Laughton, M.A., F.R.A.S., President, in the chair. The Earl of Dalhousie, K.T., T. H. Davis, D. E. Embleton, M.R.C.S., J. Hargreaves, and T. L. Lewington were elected Fellows of the Society.

Before proceeding to the ordinary business, the President called attention to the honour recently done to the Society by Her Majesty in permitting it to be entitled the Royal Meteorological Society. He also announced the loss by death of Mr. C. Greaves, C.E., Past President of the Society, and of Sir W. Siemens, F.R.S., to whom the Society was indebted for valuable assistance in the establishment of its experiments on Boston Church Tower.

The following papers were read:—

1. "*Report on Temperatures in two different patterns of Stevenson Screen*," by E. Mawley, F.R.Met.Soc.—The screens employed were an ordinary Stevenson screen obtained from Casella, and a new

Stevenson screen made in accordance with the recommendations of a Committee appointed by the Council of the Society. The new screen is two inches wider and deeper than the old screen. It has also an upper sloping roof, and, at a little distance below, a flat inner roof pierced with holes for ventilation, while the old screen has a single flat roof with only a narrow slit beneath on each side for ventilation. Observations were made during the three months, July to September, and the results are given in the paper. From these it appears that the records from the two screens are nearly identical, but that the new screen is, of the two, slightly cooler and better ventilated, and retains the heat of the sun for a less time than the old screen; also, having a double roof and overlapping boards below, it is better suited for extreme climates.

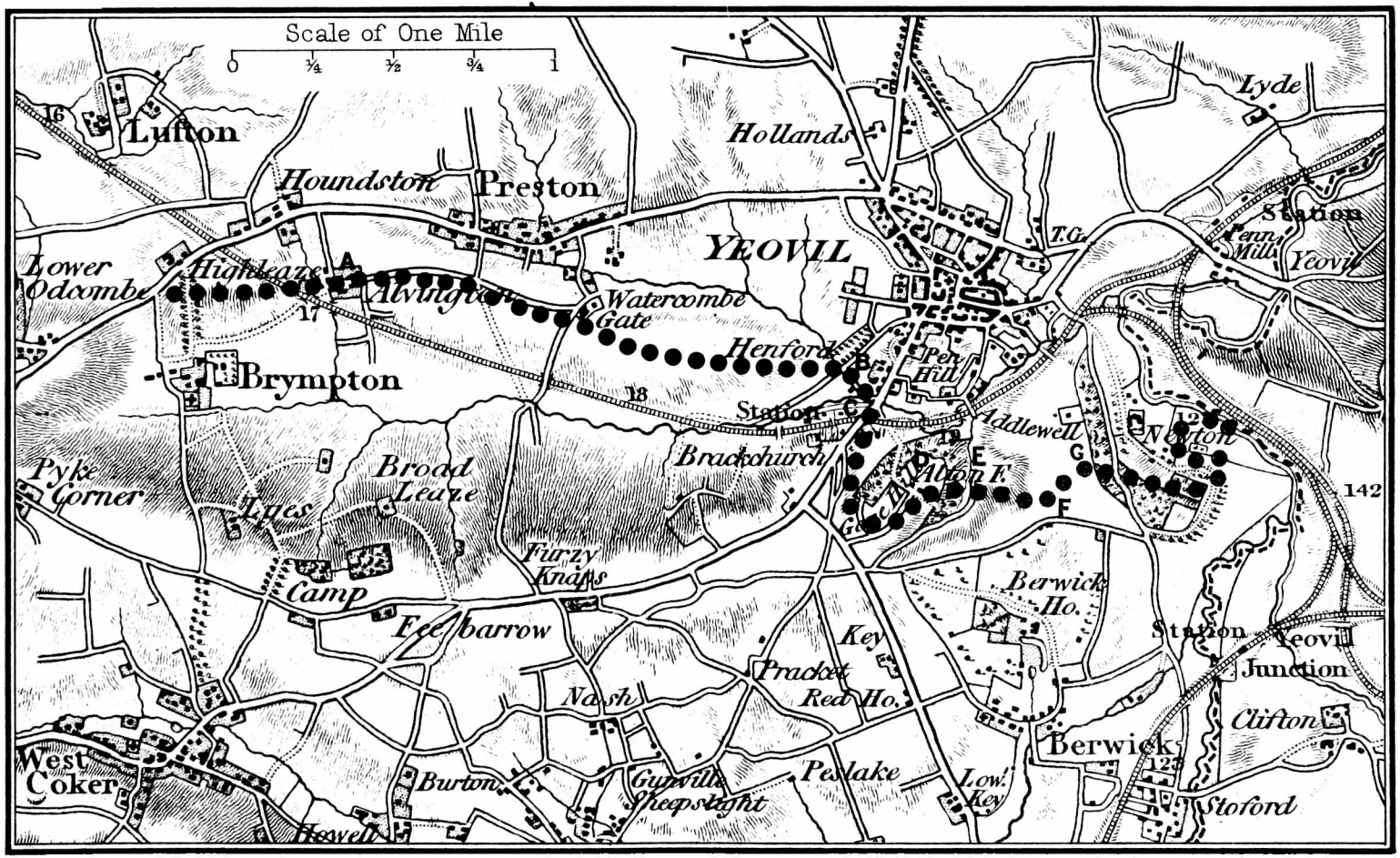
2. *On the Storm which crossed the British Islands between September 1st and 3rd, 1883, and its track over the North Atlantic*, by C. Harding, F.R. Met. Soc., of the Meteorological Office.—This storm caused considerable havoc in the south-west and south of England, owing not only to its exceptional violence, but also to its occurrence before the completion of the harvest. The storm is traceable in the first instance to two centres of disturbance, one being first shown at about 450 miles to the south of Bermuda on the 26th of August, and the other to the east of the Rocky Mountains on the 27th; these two disturbances afterwards merged on the 29th at about 300 miles to the north of Bermuda, and formed one great and destructive gale, which continued to grow in violence as it crossed the Atlantic until it reached the coast of the British Islands. The average speed at which this storm crossed the Atlantic was fully forty miles an hour, which is more than double the usual speed of storms which traverse that ocean.

3. *On the Influence of the Moon on the Height of the Barometer within the Tropics*, by Robert Lawson, Inspector-General of Hospitals.

4. *The Great Ice-storm of July 3rd, 1883, in North Lincolnshire*, by J. Cordeaux.—The direction of the storm was nearly south-east to north-west, and it travelled from Caistor along the higher ridges of the hills to Barton-on-Humber. The storm commenced at about 9.20 p.m. with large drops of rain, which soon became heavy and was followed—amidst the blaze of lightning and the constant roll of thunder—by the rush of hail or rather lumps of ice. An eye-witness remarked that they were not like hailstones but "salt-cellars;" another that they resembled "duck's eggs;" in fact, they were solid lumps of ice of every shape and size, weighing from 2 ozs. to 6 ozs., and some were measured 6 inches in circumference. The injury done to the growing crops cannot be estimated at less than £20,000.*

* For another account see *Met. Mag.* vol. xviii. p. 85.

TRACK OF YEOVIL WHIRLWIND, NOVR 17TH 1883.



Stanford's Geogl Estabt London